Contingency Tables Worksheet Solutions

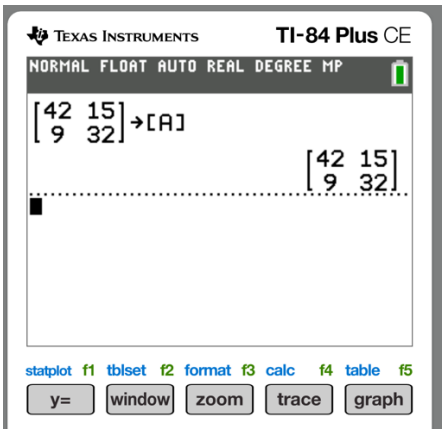
χ^2 Test

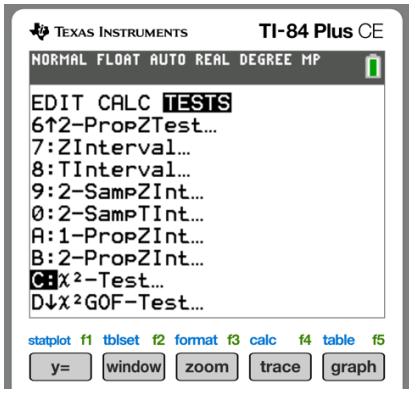
1. **Polygraph (Lie Detector) Test-** In the table below, it is known whether the person lied or did not lie. The results illustrates whether the polygraph tests were correct. Use the **5% level of significance** to test the claim that whether a subject lied is independent of the polygraph test indication.

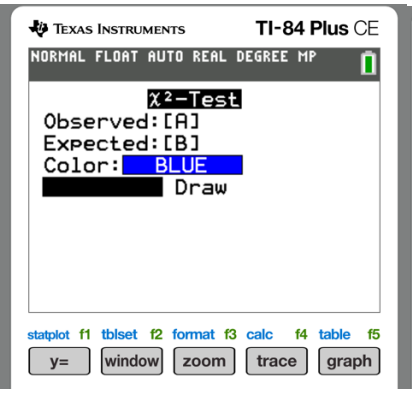
	Lied	Did Not Lie	Total
Polygraph Test Indicated a Subject Lied	42	15	57
Polygraph Test Indicated a Subject did Not Lie	9	32	41
Total	51	47	98

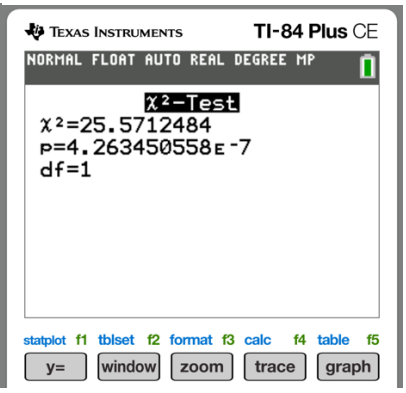
Modern Method

H_0: The row and columns variables are Independent.
H_1: The row and columns variables are dependent.









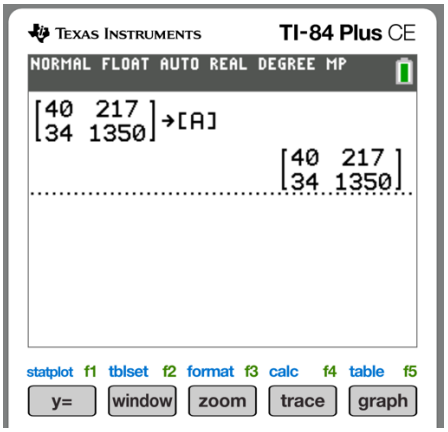
$p \approx 0.000;\ p < \alpha;$ **p value is low, H_0 has to go!**
The Sample suggests the results are dependent.
Polygraphs are effective in determining truth versus lies.

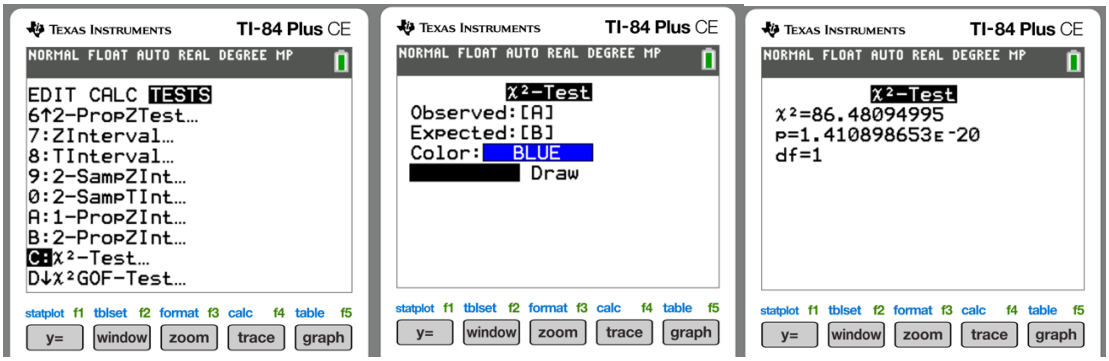
2. **Nurse a Serial Killer-** Evidence for a nurse being accused of killing her patients was provided below. The Accused was Kristen Gilbert of Massachusetts. Use the **1% level of significance** to test the defenses claim that deaths on shifts are independent of whether Gilbert was working.

	Shifts with a Death	Shifts without a Death	Total
Gilbert Was Working	40	217	257
Gilbert Was Not Working	34	1350	1384
Total	74	1567	1641

Modern Method

H_0: The row and columns variables are Independent.
H_1: The row and columns variables are dependent.





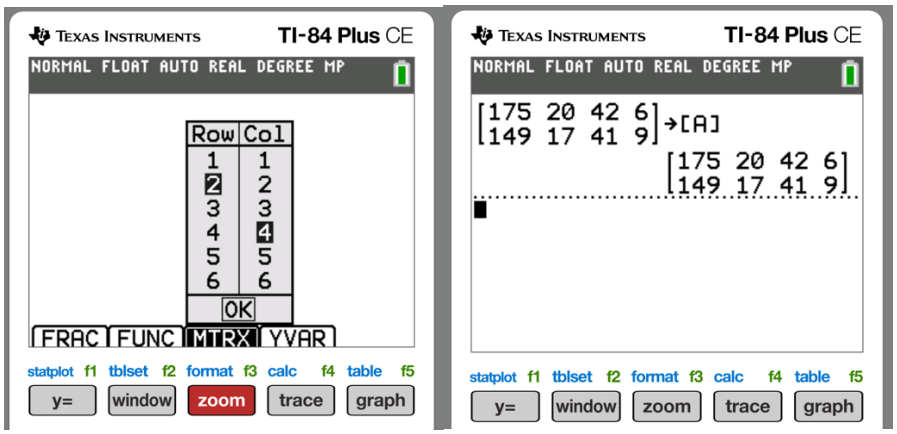
$p \approx 0.000$; $p < \alpha$; p value is low, H_0 has to go!
The Sample suggests the results are dependent.
Results favor the guilt of Kristen Gilbert

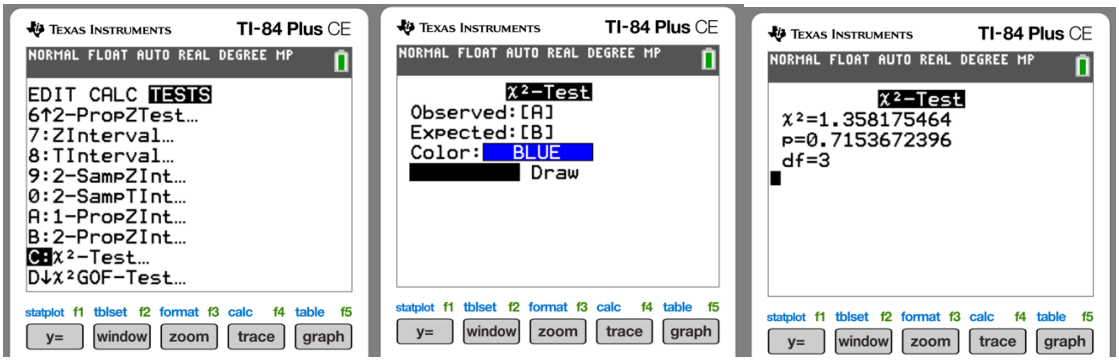
3. **Seatbelt Use Independent of Cigarette Smoking-** The study of seatbelt users versus the amount of smoking was conducted and summarized in the table below. Use **5% level of significance** to test the claim that the amount of smoking is independent of seatbelt use. The theory is that people who smoke are less concerned about their health safety and therefore less inclined to wear seatbelts.

	0	1 to 14	15 to 34	at least 35	Total
Wear Seatbelts	175	20	42	6	195
Don't Wear Seat Belts	149	17	41	9	166
Total	324	37	83	15	361

Modern Method

H_0: The row and columns variables are Independent.
H_1: The row and columns variables are dependent.





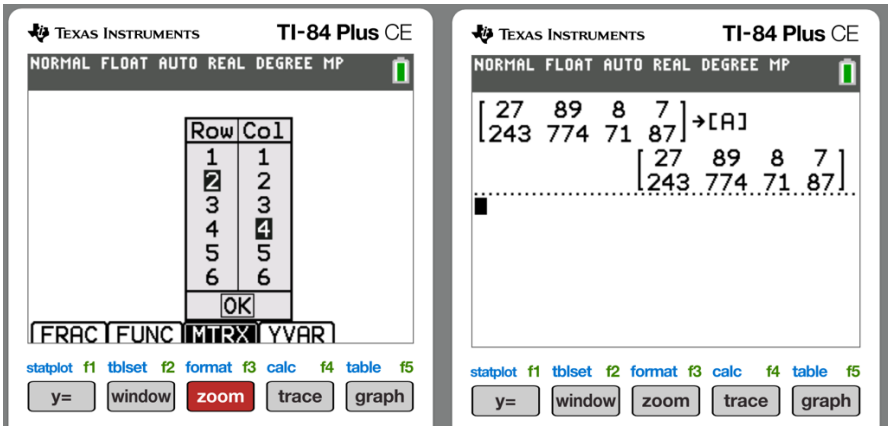
$p \approx 0.715; p \prec \alpha$; **Accept** H_0
Wearing Seatbelts is Independent from Smoking
The Theory is Not Supported by the Data

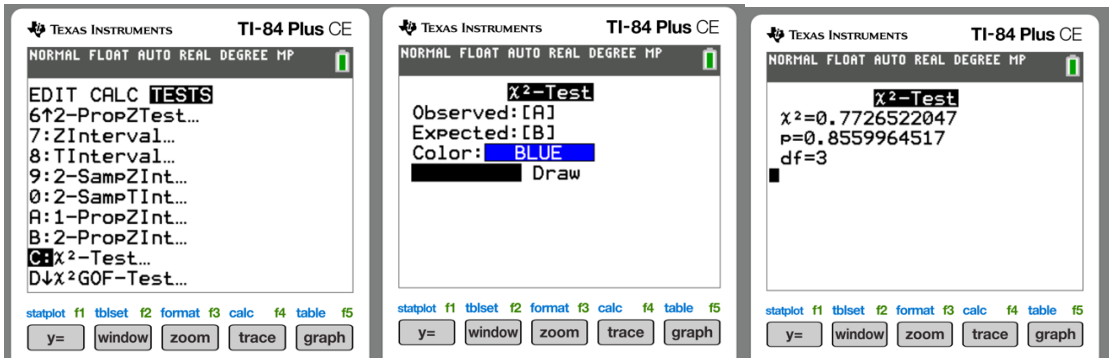
4. **Clinical Trial of Lipitor (Atorvastatin) -** Lipitor is a drug used to reduce cholesterol in patients. Adverse reactions have been studied in clinical trials and the table below summarizes the results for infections with patients from different treatment groups. Use the **1% level of significance** to test the claim that getting an infection is independent of the treatment.

	Placebo	Lipitor 10 mg	Lipitor 40 mg	Lipitor 80 mg	Total
Infection	27	89	8	7	131
No Infection	243	774	71	87	1175
Total	270	863	79	94	1306

Modern Method

H_0: The row and columns variables are Independent.
H_1: The row and columns variables are dependent.





$p \approx 0.856; p \prec \alpha$; **Accept** H_0

Infections and Lipitor treatment are independent.

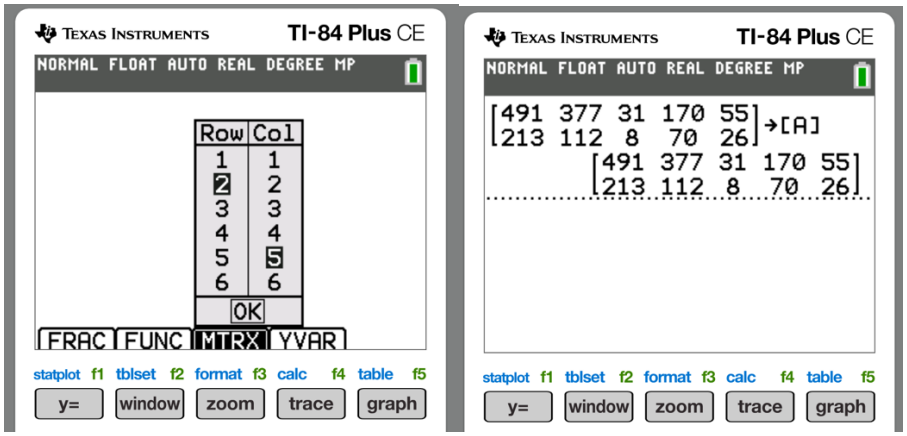
Lipitor treatment does not appear to influence infections.

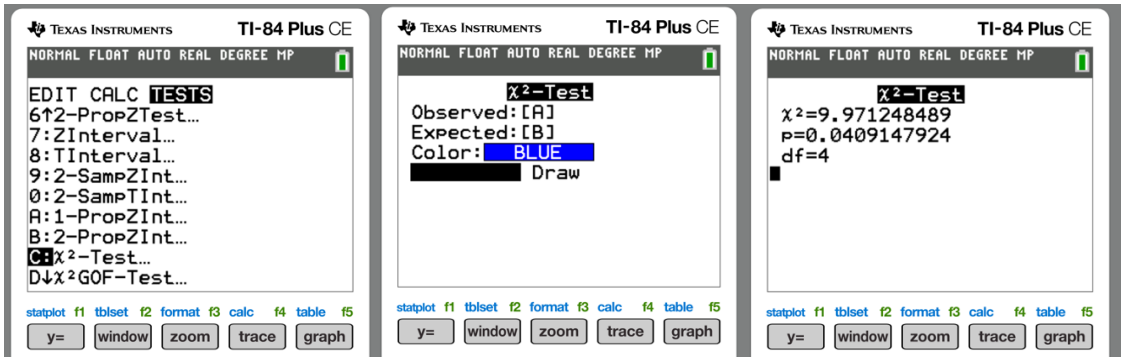
5. **Injuries and Motorcycle Helmet Color-** Summary of a case-control study are provided below detailing the color of motorcycle helmets and whether they were injured or killed in a motorcycle crash. Use the **5% level of significance** to test the claim that injuries are independent of helmet color.

	Black	White	Yellow	Red	Blue	Total
Controls (not Injured)	491	377	31	170	55	1124
Injured or Killed	213	112	8	70	26	429
Total	704	489	39	240	81	1553

Modern Method

H_0: The row and columns variables are Independent.
H_1: The row and columns variables are dependent.





$p \approx 0.041$; $p < \alpha$; p value is low, H_0 has to go!
The Sample suggests the results are dependent.
It appears motorcycle riders should wear a yellow helmet.